

TEST METHODS FOR WASTE CHARACTERIZATION AND CLASSIFICATION

March, 1986



Ontario

**Ministry
of the
Environment**

11 MAR 1986
BIOLOGY, SECT, 5805, TOL
L. 101, 100

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**TEST METHODS
FOR
WASTE
CHARACTERIZATION
AND
CLASSIFICATION**

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ONTARIO MINISTRY OF THE ENVIRONMENT**

March 1986

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ACKNOWLEDGEMENTS

The test methods presented herein are adapted from procedures recommended by the United States Environmental Protection Agency, the American Society for Testing Materials and the International Petroleum Institute.

Only those methods specified in Bill 309 are to be considered official for any judicial purposes.

My thanks are due to Mrs. June Poliacik for preparing the diagrams.

INTRODUCTION

A Regulation (Bill 309) has been enacted to legislate the handling of industrial waste material and to ensure its disposal in an environmentally safe and socially acceptable manner. Waste generators, waste haulers and waste receivers share the primary responsibility for the waste from "cradle to grave". The Ontario Ministry of the Environment has also defined which wastes are hazardous either by their intrinsic properties or as determined by tests mandated in Bill 309. These wastes require special treatment.

This document presents test methods which shall be used to identify hazardous wastes, as well as test methods which are not part of Bill 309 but may aid regional staff of the Ministry in characterizing industrial waste materials. It represents an initial endeavor by the Laboratory Services Branch to deal with an emerging and extremely complex field of investigation and it is anticipated that other methods will be added to the ones presented at this time, as further expertise is developed.

THE DETERMINATION OF LEACHATE TOXICITY

SCOPE

The Leachate Extraction Procedure is intended primarily as a means for classifying wastes based on the leachability of contaminants in a waste material. A waste sample is treated with a dilute acetic acid solution, using a tumbler extraction technique, for a twenty-four hour period of time. The concentrations of contaminants in the leachate produced are measured and compared to the concentrations specified in the Waste Management Regulation.

Leachate containing concentrations less than one hundred times those specified in Schedule 4 of the Waste Management Regulation, classifies the waste as non-hazardous. Waste material, with leachate concentrations of contaminants equal to or greater than one hundred times those proscribed in Schedule 4, is classified as hazardous waste.

Although not required by the Regulation, this procedure may also be used to determine whether a waste can be used as a fill material on land. Leachate, using distilled water, for a landfill material shall not contain contaminant concentrations higher than those specified by a District Officer of the Ontario Ministry of the Environment. Criteria for fill material intended for disposal in open waters will be determined on an individual basis by the same authorities.

Wastes are normally extracted in their unaltered physical state, or if the aggregate particle size is greater than 9.5 mm, after comminution. Exceptions may be made for hard slag-like wastes or treated solidified wastes, which are likely to remain physically stable in a landfill site. The structural integrity procedure should be followed to determine if a particular waste requires comminution.

THE DETERMINATION OF LEACHATE TOXICITY

METHOD A. Leachate Extraction Procedure

(1) SAMPLING

Collect a sufficient amount of sample to provide approximately 100 g of solid material, using techniques which ensure that the sample is representative of the waste to be tested.

(2) EQUIPMENT

- 2.1 Sieve, 9.5 mm mesh opening, stainless steel or plastic material.
- 2.2 Stainless steel filtration unit, 142 mm diameter, minimum 1L capacity, capable of sustaining a pressure of 5 kg/cm², applied to the solution to be filtered.
- 2.3 Membrane filter, 142 mm diameter, 0.45 μ m diameter pore size, made of synthetic organic material such as cellulose acetate, cellulose nitrate, nylon or polycarbonate and which is compatible with the leachate to be filtered. Teflon is recommended for organic constituents.
- 2.4 Glass fibre prefilter, 124 mm diameter, 3 μ m to 12 μ m pore size range
- 2.5 Vacuum filtration unit, 90 mm diameter.
- 2.6 Membrane filter 90 mm diameter as per Step 2.3.
- 2.7 Glass fibre filter 70 mm diameter as per Step 2.4.
- 2.8 Solid waste rotary extractor - a device that rotates the bottles end overend about a central axis through 360°, with a speed of 10 rpm.

The dimensions of the box will depend on the needs of each laboratory. (Figure 1).

- 2.9 Structural Integrity Tester with a 3.18 cm diameter hammer weighing 0.33 kilogram and having a free fall of 15.24 cm. (Figure 2).
- 2.10 pH meter, with a readability of 0.01 pH unit and accuracy of ± 0.1 pH units.
- 2.11 Cylindrical bottles, wide mouth, 1250 mL capacity, polyethylene or glass with Teflon lined cap for inorganic constituents; glass with Teflon-lined cap or Teflon bottles for organic constituents.
- 2.12 Cleaning Procedure

All glassware and equipment that comes into contact with the sample should be cleaned in the following way before each use:

- 2.12.1 Wash with a non-phosphate detergent solution.
- 2.12.2 Rinse twice with tap water.
- 2.12.3 Rinse twice with reagent water.
- 2.12.4 Wash with 10% nitric acid.
- 2.12.5 Rinse several times with reagent water.
- 2.12.6 Store bottles filled with 10% nitric acid, until ready to use.
- 2.12.7 Rinse several times with reagent water before use.
- 2.12.8 Rinse clean oven dried bottles with methylene chloride, followed by methanol, for organic constituents.

(3) REAGENTS

- 3.1 Acetic acid, 0.5 N. Dilute 29.4 mL of concentrated acetic acid (ACS grade) to 1000 mL with reagent water.
- 3.2 Reagent water, Type IV (ASTM Specification D 1193). For organic parameters, the reagent water should be free of any organic substances to be analyzed (ASTM Type 1).
- 3.3 Nitric acid, 10% (v/v). Add 100 mL of concentrated nitric acid (ACS grade) to 900 mL of reagent water.
- 3.4 Nitrogen gas, prepurified, scrubbed through a molecular sieve.

(4) SEPARATION PROCEDURE

If the sample contains a distinct liquid and a solid phase, separate it into its component phases using the following procedure:

- 4.1 Determine the dry weight of the solids in the sample at 60 °C, using a well homogenised sample. Use this weight to determine the amount of material to be filtered in Step 4.8.
- 4.2 Assemble the filtration unit with a filter bed consisting of a 0.45 μ m pore size membrane filter and a coarse glass fibre pre-filter upstream of the membrane filter (per manufacturer's instructions).
- 4.3 Select one or more blank filters from each batch of filters. Filter 50 mL portions of reagent water through each test filter and analyze the filtrate for the analytical parameters of interest. Note the volume required to reduce the blank values to acceptable levels, if necessary.
- 4.4 Wash each filter used in the leach procedure with at least this pre-determined volume of water. Filter under pressure until no water flows through the filtrate outlet.

- 4.5 Remove the moist filter bed from the filtration unit and determine its weight to the nearest ± 0.01 g.
- 4.6 Re-assemble the filtration unit, replacing the filter bed, as before.
- 4.7 Comminute the sample, with a mortar and pestle, to a size that will pass through the opening of the filtration unit (less than 9.5 mm).
- 4.8 Agitate the sample by hand and pour a representative aliquot of the solid and liquid phases into the opening of the filtration unit. Filter a sufficient amount of the sample to provide at least 60 g of dry solid material.
- 4.9 Pressurize the reservoir very slowly with nitrogen gas by means of the regulating valve on the nitrogen gas cylinder, until liquid begins to flow freely from the filtrate outlet.
- 4.10 Increase the pressure step-wise in increments of 0.5 kg/sq. cm to a maximum of 5 kg/sq. cm, as the flow diminishes. Continue filtration until the liquid flow ceases or the pressurizing gas begins to exit from the filtrate outlet of the filter unit.
- 4.11 De-pressurize the filtration unit slowly using the release valve on the filtration unit. Remove and weigh the solid material together with the filter bed to ± 0.01 g. Record the weight of the solid material.
- 4.12 Measure and record the volume and pH of the liquid phase. Store the liquid at 4 °C under nitrogen until required in Step 5.13.
- 4.13 Discard the solid portion, if the weight is less than 0.5% (w/v) of the aliquot taken. If not, proceed to Step 5.1.

Note: For mixtures containing coarse grained solids, where separation can be performed without imposing a 5 kg/sq. cm differential pressure, a vacuum filtration unit with a filter bed as per Step 4.2 may be used. Vacuum filtration must not be used, if volatile organic compounds are to be analysed.

(5) EXTRACTION PROCEDURE

- 5.1 Prepare a solid sample for extraction by crushing, cutting or grinding, to pass through a 9.5 mm mesh sieve. If the original sample contains both liquid and solid phases, use the solid material from Step 4.13. The structural integrity procedure, Step 6 should be used for monolithic wastes which are expected to maintain their structural integrity in a landfill, (e.g. some slags and treated solidified wastes).

Note: Do not allow the solid waste material to dry prior to the extraction step.

- 5.2 Determine the moisture content of the de-watered sample, by drying a suitable aliquot to constant weight at 60 °C in an oven. Discard the dried solid material.
- 5.3 Place the equivalent of 50 g dry weight of the de-watered undried material into a 1250 mL wide mouth cylindrical bottle. Use additional bottles, if a larger volume of leachate is required for the analysis.
- 5.4 Add 800 mL (less the moisture content of the sample in mL) of reagent water to the bottle.
- 5.5 Cap the bottle and agitate it in the rotary extractor for 15 minutes before pH measurement.
- 5.6 Measure and record the pH of the solution in the bottle using a pH meter, calibrated with buffers at pH 7.00 and pH 4.00. The solution should be stirred during the pH measurement.

- 5.7 Proceed to Step 5.10.1, if the pH is less than 5.2.
- 5.8 Add a sufficient volume of 0.5N acetic acid if the pH is greater than 5.2 to bring the pH to 5.0 ± 0.2 .

Note: Maximum Amount of Acid: No more than 4 mL of 0.5N acetic acid per gram of dry weight of sample may be added during the entire procedure. If the pH is not lowered to 5.0 ± 0.2 with this amount, proceed with the extraction.

- 5.9 Cap the bottle and place it in the tumbling apparatus. Rotate the bottle and its contents at 10 rpm for 24 hours at room temperature (20°C to 25°C).
- 5.10 Monitor, and manually adjust the pH during the course of the extraction, if it is greater than 5.0 ± 0.2 . The following procedure should be carefully followed:
- 5.10.1 Measure the pH of the solution after 1 hour, 3 hours and 6 hours from the starting time. If the pH is above 5.2, reduce it to pH 5.0 ± 0.2 by addition of 0.5N acetic acid. If the pH is below 5.0 ± 0.2 , do not make any adjustments.
- 5.10.2 Adjust the volume of the solution to 1000 mL with reagent water, if the pH is below 5.0 ± 0.2 after 6 hours.
- 5.10.3 Measure and reduce the pH to 5.0 ± 0.2 , if required, after 22 hours and continue the extraction for an additional 2 hours.
- 5.11 Add enough reagent water at the end of the extraction period so that the total volume of liquid is 1000 mL. Record the amount of acid added and the final pH of the solution.

- 5.12 Separate the material into its component liquid and solid phases as described under the Separation Procedure Step 4. Discard the solid portion.

Note: *It may be necessary to centrifuge the suspension at high speed before filtration, for leachates containing very fine grained particles.*

- 5.13 Calculate the amount of free liquid from Step 4.12 corresponding to 50 g of the dry solid material. Add this amount to the leachate from Step 5.12.

Note: *If the analysis is not performed immediately, store separate aliquots of the leachate at 4 °C, after adding appropriate preservatives for the analytical parameters of interest (See "A Guide to the Collection and Submission of Samples for Laboratory Analysis", Ontario Ministry of the Environment, July 1979).*

- 5.14 Analyze the combined solutions from Step 5.13 for contaminants listed in Schedule 4, that are likely to be present.
- 5.15 Report concentrations of contaminants in the combined leachate and the free liquid solution as mg/L.
- 5.16 Carry a blank sample through the entire procedure, using dilute acetic acid at pH 5.0 ± 0.2 .

6.0 STRUCTURAL INTEGRITY PROCEDURE

This procedure may be required prior to extraction for some samples as indicated in Step 5.1. It may be omitted for wastes with known high structural integrity.

Procedure

- 6.1 Fill the sample holder with the material to be tested. If the sample of the waste is a large monolithic block, cut a portion from the block measuring 3.3 cm in diameter by 7.1 cm in length. For a treated waste (e.g. solidified waste), samples may be cast in a form with the above dimensions for the purposes of conducting this test. In such cases, the waste should be allowed to cure for 30 days prior to further testing.
- 6.2 Place the sample holder in the structural integrity tester, then raise the hammer to its maximum height and allow it to fall. Repeat this procedure 14 times.
- 6.3 Remove the material from the sample holder, and proceed to Step 5.2. If the sample has not disintegrated, it may be sectioned; alternatively use the entire sample (after weighing) and a sufficiently large bottle as the extraction vessel. The volume of reagent water to be initially added is 16 mL/g of dry sample weight. The maximum amount of 0.5N acetic acid to be added is 4 mL/g of dry sample weight. The final volume of the leachate should be 20 mL/g of dry sample weight.

SCHEDULE 4

Leachate Quality Criteria

<u>Hazardous Waste Number</u>	<u>Contaminant</u>	<u>Concentration (milligrams per litre)</u>
ON4001	2,4,5-TP / Silvex / 2-(2,4,5-Trichlorophenoxy) propionic acid	0.01
ON4002	2,4-D	0.1
ON4003	Aldrin + Dieldrin	0.0007
ON4004	Arsenic	0.05
ON4005	Barium	1.0
ON4006	Boron	5.0
ON4007	Cadmium	0.005
ON4008	Carbaryl / 1-Naphthyl-N-methyl carbamate / Sevin	0.07
ON4009	Chlordane	0.007
ON4010	Chromium	0.05
ON4011	Cyanide (free)	0.2
ON4012	DDT	0.03
ON4013	Diazinon / Phosphordithioic acid, 0,0-diethyl 0-(2-isopropyl- 6-methyl-4-pyrimidinyl) ester	0.0002
ON4014	Endrin	0.0002
ON4015	Fluoride	2.4
ON4016	Heptachlor + Heptachlor epoxide	0.003
ON4017	Lead	0.05
ON4018	Lindane	0.004
ON4019	Mercury	0.001
ON4020	Methoxychlor / 1,1,1-Trichloro-2, 2-bis(p-methoxyphenyl)ethane	0.1

ON4021	Methyl Parathion	0.007
ON4022	Nitrate + Nitrite	10.0
ON4023	Nitrilotriacetic acid	0.05
ON4024	Nitrite	1.0
ON4025	PCB's	0.003
ON4026	Parathion	0.035
ON4027	Selenium	0.01
ON4028	Silver	0.05
ON4029	Toxaphene	0.005
ON4030	Trihalomethanes	0.35
ON4031	Uranium	0.02

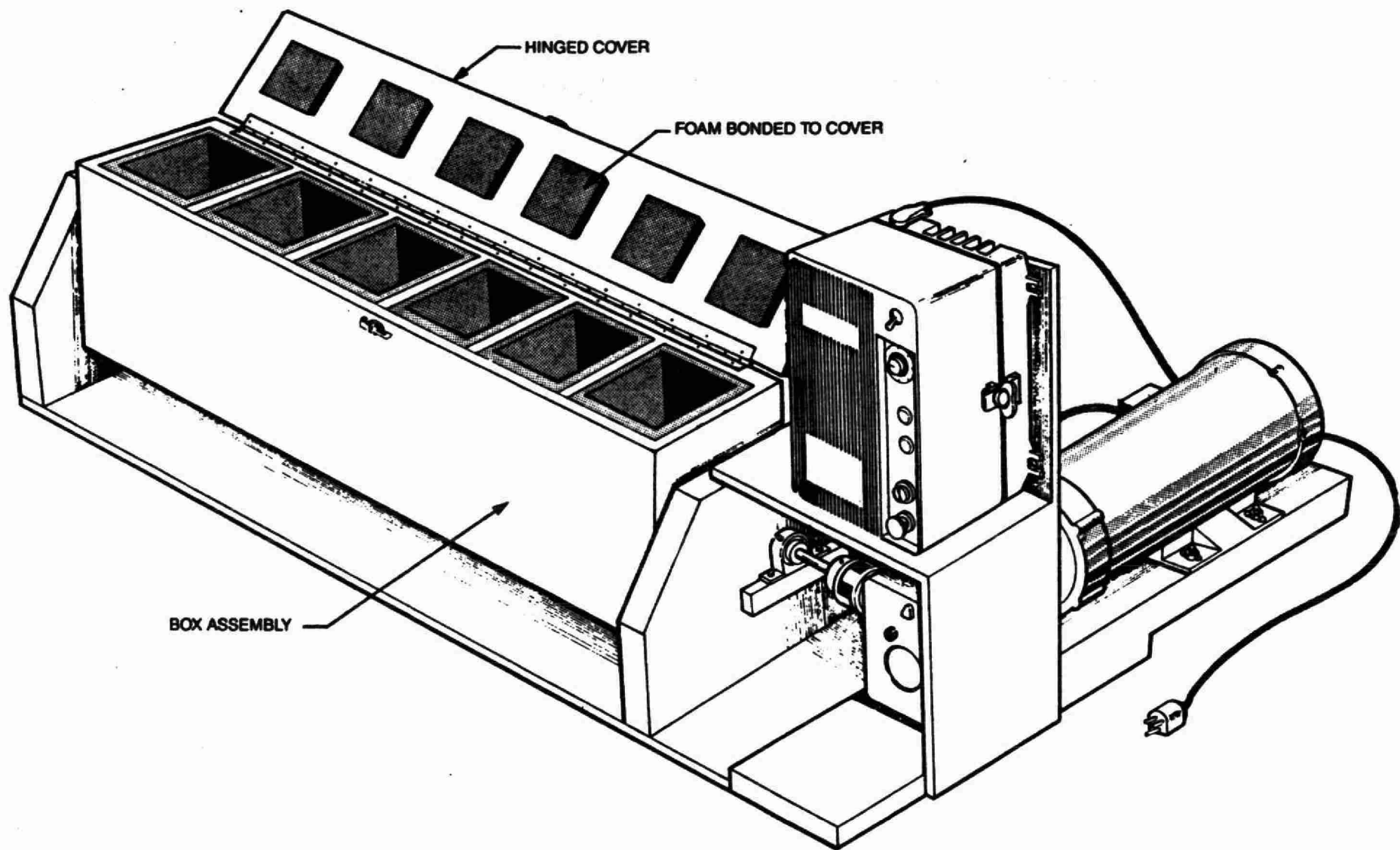


FIGURE 1
SOLID WASTE ROTARY EXTRACTOR

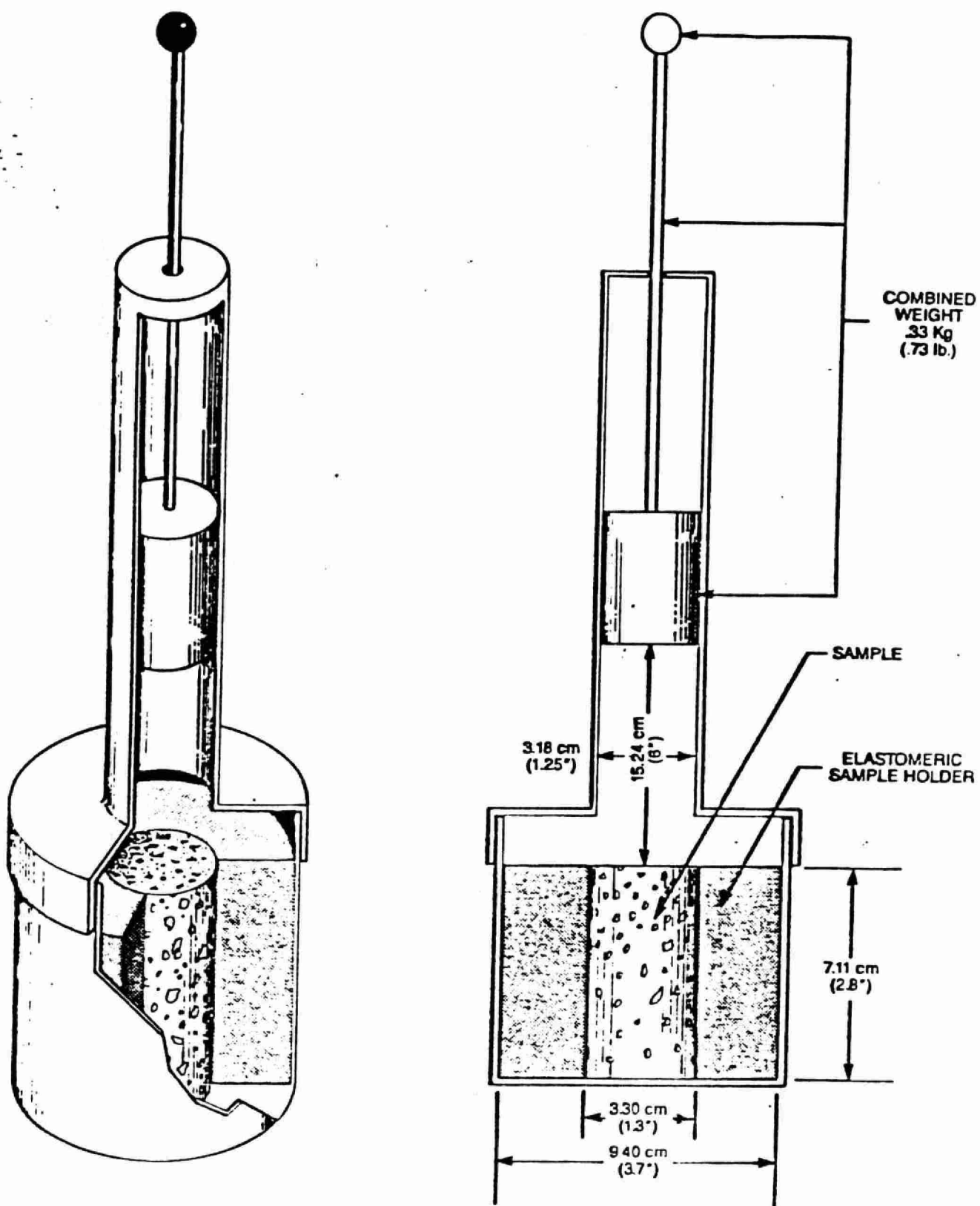


FIGURE 2
STRUCTURAL INTEGRITY TESTER

**THE DETERMINATION OF THE AMOUNT OF SLUMP FOR THE CLASSIFICATION OF
"LIQUID" INDUSTRIAL WASTE**

SCOPE

This test method describes the procedure for determining the amount of slump of a waste material. It may be used in both the laboratory and the field to define liquid wastes under the Regulation (Bill 309)

THE DETERMINATION OF THE AMOUNT OF SLUMP FOR THE CLASSIFICATION OF "LIQUID" INDUSTRIAL WASTE

(Slump Test)

(1) SAMPLING

Collect a sufficient amount of material using techniques which ensure that the aliquot taken is representative of the waste material to be tested.

(2) EQUIPMENT

- 2.1 Mould: The mould should be in the form of the lateral surface of the frustrum of a cone, with a base 200 mm in diameter, top 100 mm in diameter and a height of 300 mm. All dimensions should be within ± 3 mm. The base and the top should be open, parallel to each other and at right angles to the axis of the cone. The cone should be made of metal not thinner than 1.5 mm and should be inert to the waste to be tested. The cone should be seamless and the interior should be smooth and free of dents. The outer surface should contain two handles to lift the cone, and foot pieces to attach to the base plate, (Figure 1).
- 2.2 Base plate: The base plate should be of non-absorbing material, containing a clamping mechanism, which can be released without disturbing the cone, (Figure 1).
- 2.3 Tamping Rod: The tamping rod should be a cylindrical rod, 16 mm in diameter and approximately 600 mm in length, having one end rounded to a hemispherical tip, 16 mm in diameter.

(3) PROCEDURE

- 3.1 Perform the test at a temperature of not less than 10°C. Dampen the mould with water and place it on a flat, rigid, non-absorbent but moist surface. Hold the mould firmly in place using the clamps on the base plate.
- 3.2 Fill the mould in 3 layers from the sample of the material obtained each layer approximately one-third the volume of the mould, as follows:
- 3.3 Pour the first (bottom) layer into the mould to a depth of 70 mm.
- 3.4 Rod first layer with 25 strokes of the tamping rod. For the first layer, it will be necessary to incline the rod slightly so as to make approximately half the strokes around the perimeter and then progressing spirally with vertical strokes towards the centre portion.
- 3.5 Add the second (middle) layer to the mould to a cumulative depth of 160 mm.
- 3.6 Rod as before, 25 times with the strokes just penetrating the surface of the first layer.
- 3.7 Heap the third (top) layer above top edge of mould.
- 3.8 Rod as before, 25 times with the strokes just penetrating the surface of the second layer. If the rodding results in subsidence of the material below the top edge of the mould, add additional material to keep an excess of material above the top at all times.
- 3.9 Remove the excess material above the top of the mould by means of a screeding and rolling motion of the tamping rod, after rodding the third layer.
- 3.10 Remove spilled material from the base of the mould.

Immediately following steps 3.9 and 3.10, release the clamps and using the handles, lift the mould vertically in a steady upward motion which should be completed in approximately 5 seconds. Avoid any lateral or torsional motion during this procedure.

Note: *The entire operation of filling, tamping and removal of the mould should be completed within an elapsed time of two (2) minutes.*

4) **MEASUREMENT OF SLUMP**

Determine the amount of slump, immediately after removal of the mould by, measuring the difference between the height of the mould and the average height of the top surface of the material after subsidence. Slump specimens that break or slump laterally give incorrect results. If this happens, repeat the test with a new sample.

Note: (1) *If two consecutive tests on sample material show a falling-away or shearing-off of a portion of the material from the mass of the specimen, the material probably lacks necessary plasticity and cohesiveness for the slump test to be applicable.*

(2) *Duplicate slump tests from the same material sample should not vary by more than 10 mm.*

(5) **CALCULATIONS**

Slump = 300 mm - height in mm of the cone after subsidence.

(6) **REPORTING**

Report the slump in millimetres to the nearest 10 mm of subsidence.

(7) **INTERPRETATION**

Any waste sample tested that records a slump of more than 150 mm or shows a falling away or shearing off of material from the mass of the specimen (Note 4.1) is classified as a liquid waste.

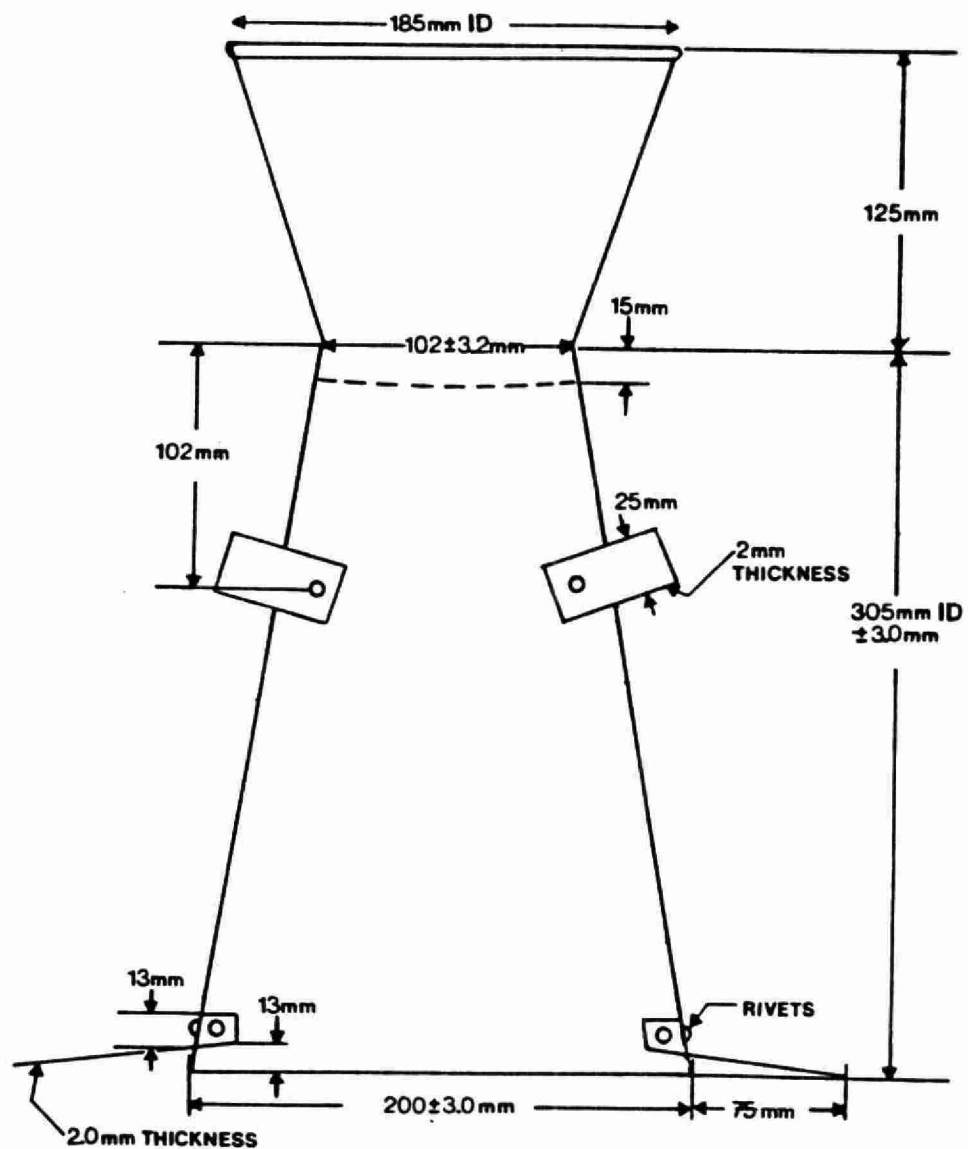
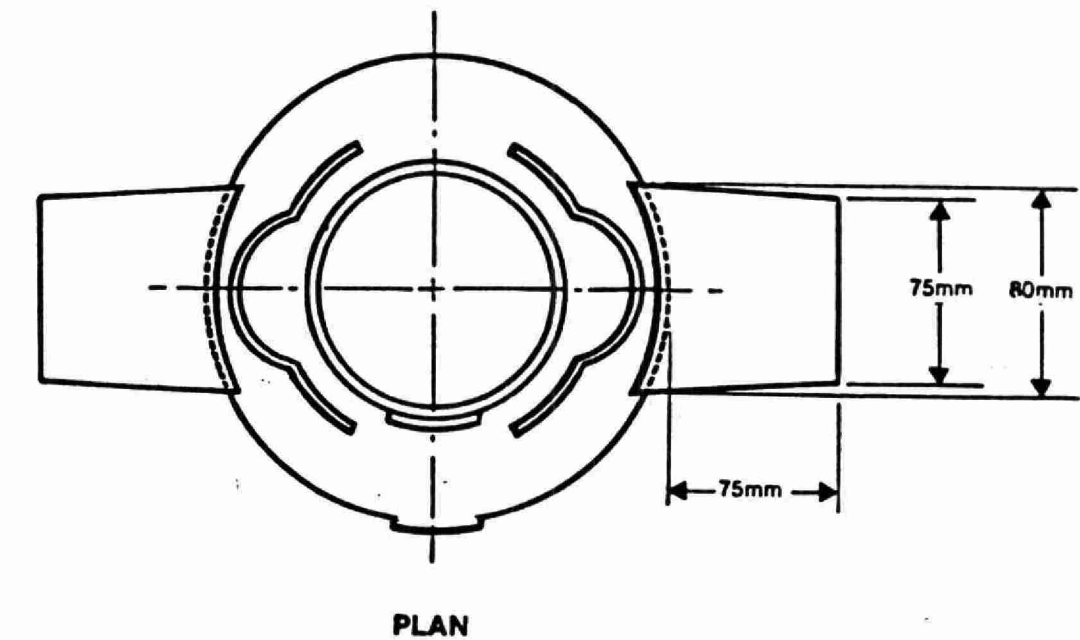


FIGURE 1

MOULD FOR SLUMP TEST

THE DETERMINATION OF CORROSIVITY

SCOPE:

These methods are used to determine the corrosive properties of a liquid industrial wastes, either by measurement of the hydrogen ion concentration or by the determination of the degree of dissolution of a special steel plate. Waste liquids that have a pH equal to or less than 2 pH units or equal to or greater than 12.5 pH units or that cause a corrosion of the steel plate equal to or greater than 6.35 mm/year are classified as hazardous wastes.

THE DETERMINATION OF CORROSIVITY

(1) SAMPLING

Samples should be collected using techniques which ensure that the aliquot taken is representative of the waste to be tested.

METHOD A. The Determination of pH

(2) EQUIPMENT

2.1 pH Meter with a readability of .01 pH unit and and accuracy of ± 0.1 pH units.

2.2 pH electrode, Ingold 405-88TW-K7.

2.3 Magnetic stirrer with stirring bar.

(3) REAGENTS

3.1 pH paper, pH Fix 0 - 14, Machery-Nagel, W. Germany Cat. #921-10.

3.2 pH electrode filling solution Ingold Friscolyt, Cat. # 9817.

3.3 pH electrode filling solution, KCl 3M, saturated with AgCl, Ingold Cat. #9811.

3.4 Buffer solutions, range 1-14 pH units.

(4) PROCEDURE

4.1 Pour a representative aliquot of the sample into a beaker

4.2 Place the beaker on the stirrer and stir its contents using a magnetic stirring bar.

- 4.3 Dip the pH paper into the liquid waste sample for 30 seconds.
- 4.4 Determine the approximate pH by matching the colours on the pH paper with the chart provided.
- 4.5 Standardize the pH electrode using a buffer solution as close as possible in pH to that measured with the pH paper.
- 4.6 Measure the pH of the sample, stirring it during the measurement, until a stable reading is obtained.

Note: (1) for oily samples use an electrode with Friscolyt filling solution

(2) for non oily samples use an electrode with 3M KCl saturated with AgCl as the filling solution.

(5) REPORTING

Report results in pH units to one decimal place.

(6) INTERPRETATION

Samples with a hydrogen ion concentration equal to or less than 2 pH units or equal to or greater than 12.5 pH units are classified as hazardous wastes.

METHOD B. The Determination of Corrosion SAE 1020 Steel

(2) EQUIPMENT

- 2.1 Reaction flask jacketed, 1000 mL capacity, 10.2 cm dia. neck opening
- 2.2 Reaction flask head, 45/50 centre joint, 10.2 cm dia. opening
- 2.3 Teflon gasket, 10.2 cm dia. size.
- 2.4 Clamp, for 10.2 cm dia. reaction flask.
- 2.5 Circulating water bath, $\pm 0.5^{\circ}\text{C}$ accuracy
- 2.6 Variable speed stirrer with Teflon stirring rod and paddle
- 2.7 Thermometer well
- 2.8 Teflon specimen support
- 2.9 Reflux condenser 45/50 joint
- 2.10 Steel plate, SAE 1020 steel, circular, 3.75 cm dia., 0.32 cm thickness, with a mounting hole 0.80 cm dia.
- 2.11 Drying oven
- 2.12 Desiccator
- 2.13 Vernier calipers

(3) REAGENTS

- 3.1 Sodium hydroxide 20%: dissolve 20 g of NaOH (ACS grade) in 100 mL of distilled water.

- 3.2 Zinc dust
- 3.3 Laboratory detergent, free of phosphate or bleach
- 3.4 Acetone, ACS grade
- 3.5 Nitrogen gas, pre-purified

(4) PROCEDURE

4.1 Cleaning of the steel coupon

- 4.1.1 Wash the coupon with a laboratory detergent, rinse with tap water, followed by distilled water.
- 4.1.2 Place the coupon in 100 mL boiling 20% NaOH solution. Add 2 g of zinc dust and boil for 5 minutes.
- 4.1.3 Remove the coupon from the caustic solution, rinse with tap water, distilled water and finally with acetone. Dry in an oven.
- 4.1.4 Store in a desiccator until use.

4.2 Determination of the Surface Area and Weight

- 4.2.1 Measure D the diameter of the coupon, t the thickness of the coupon and d the diameter of the hole, using vernier calipers.

The surface area of the coupon is calculated by the following equation:

$$\text{Area} = (3.14/2) (D^2 - d^2) + (t)(3.14)(D) + (t)(3.14)(d).$$

If the hole is completely covered by the mounting support, the last term $(t)(3.14)(d)$ should be omitted from the calculation.

- 4.2.2 Weigh the coupon to ± 0.001 g accuracy.

4.3 Exposure to the liquid waste

- 4.3.1 Assemble the reaction kettle as shown in the diagram, (Figure 2) with the coupon soaked in the liquid waste.

Note A minimum of 40 mL of liquid/cm² of surface area should be used.

- 4.3.2 Adjust the temperature to 55.0°C ± 0.5°C, by means of the circulating water bath.

- 4.3.3 Adjust the stirring rate and rate of bubbling nitrogen so that the liquid waste is well mixed and homogeneous.

- 4.3.4 Allow the coupon to soak in the liquid waste for 24 hours.

- 4.3.5 Proceed to steps 4.1.1 to 4.1.3.

- 4.3.6 Determine the weight of the coupon after exposure to ± 0.001 gn.

- 4.3.7 Perform the entire procedure with a clean steel coupon, using distilled water instead of the liquid industrial waste.

4.4 CALCULATIONS

$$\text{Corrosion rate (mmy)} = \frac{\text{weight loss (in mg)} \times 11.45}{\text{area (cm}^2\text{)} \times \text{time (hrs.)}}$$

mmy = millimetre per year.

5.0 INTERPRETATION

Wastes that cause a corrosion equal to or greater than 6.35 mm per year are classified as hazardous wastes.

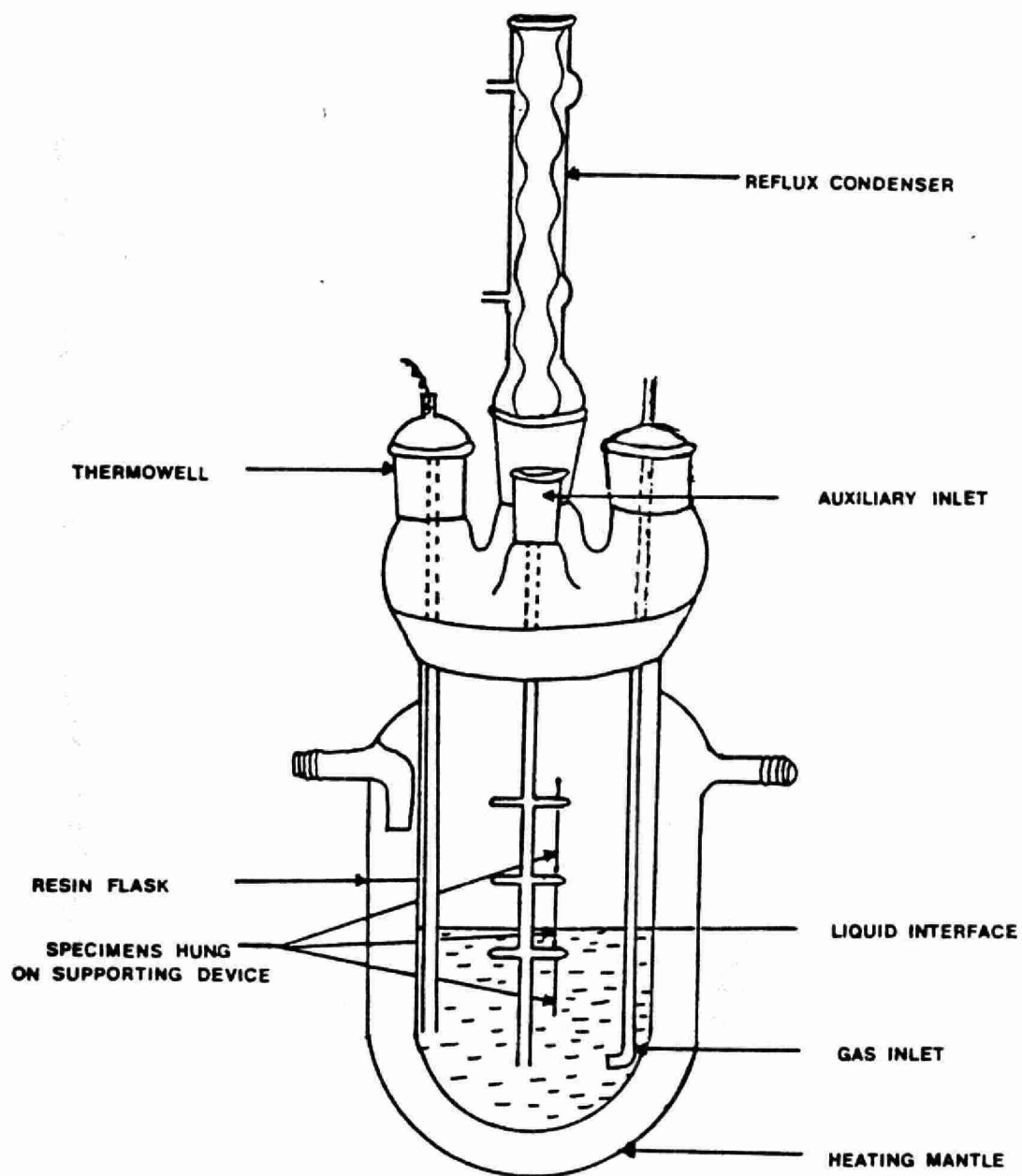


FIGURE 1

REACTION VESSEL FOR CORROSIVITY TEST

THE DETERMINATION OF FLASH POINT

SCOPE

These procedures are used to determine whether a liquid industrial waste has a flash point above or below 60°C. If the exact flash point is required, ASTM procedures D-56-79, D-3243-77, D-3278-78 or D-93-79 must be followed. Liquid wastes that have a flash point equal to or less than 61°C are classified as hazardous wastes.

THE DETERMINATION OF FLASH POINT

(1) SAMPLING

Collect approximately 100 mL of the liquid to be tested using techniques which ensure that the aliquot sampled is representative of the entire waste. Samples should be submitted to the laboratories in glass bottles with tight fitting aluminum foil-lined caps. Special care must be taken to avoid loss of volatile components of the sample.

METHOD A. Light and Moderately Viscous Samples

(2) EQUIPMENT

- 2.1 Setaflash Tester, Model Seta 1374, 0 - 100°C range.
- 2.2 Setaflash Thermometer, with a readability of 0.5°C.
- 2.4 Syringe, 2 mL pre-set volume
- 2.5 Liquified petroleum gas, Seta 1366/01 for refilling built-in tank.
- 2.6 Barometer to read in mm Hg.

(3) REAGENTS

- 3.1 1-Hexanol, flash point 60°C

(4) PROCEDURE

Safety Precautions

The method described below must be performed in a fume hood with no draft or a moderate draft. A strong draft may cause test flame instability and should be avoided.

- 4.1 Ensure that the sample cup, lid, shutter are clean and free from contamination.
- 4.2 Turn the temperature control dial fully clockwise, causing the red indicator light to glow.
- 4.3 Obtain the barometric pressure in mm Hg.

Note: *The following corrections must be made for pressure. For each 30 mm Hg interval below 760 mm Hg, add 1°C to the flash point setting. For each 30 mm Hg interval above 760 mm Hg, subtract 1°C from the flash point setting.*

- 4.4 Turn the temperature control dial counter-clockwise until the red light extinguishes, when the required temperature has been reached.

Note: *Perform the test at 30°C, 40°C, 50°C and 60°C, or the respective corrected temperatures, using a fresh 2 mL sample each time.*

- 4.5 Allow the sample cup temperature to stabilize. The red light will flicker off and on. Some fine tuning may be necessary to obtain the exact temperature.
- 4.6 Withdraw 2.0 ± 0.1 mL aliquot of the sample using a clean syringe.
- 4.7 Transfer the entire 2 mL aliquot to the sample cup through the filling orifice.

Note: *Viscous samples may be transferred directly into the sample cup. This operation must be performed quickly to avoid loss of volatile components.*

- 4.8 Set time by turning the timer knob fully clockwise.
- 4.9 Open the gas control valve and light the pilot flame and the test flame.
- 4.10 Adjust the size of the test flame to 4 mm in diameter by controlling the gas flow to the flame.
- 4.11 Depress the test flame into the vapours over the sample, when the timer rings.
- 4.12 Observe whether there is a flash or not.

Note: *The material is deemed to have flashed when a large blue flame appears and spreads over the surface of the sample. The test flame will extinguish with an audible popping sound.*

(5) QUALITY CONTROL

Follow steps 4.1 to 4.12 using 1-Hexanol (FP 60°C) as a test liquid.

(6) REPORTING

Report the test result as FLASH / NO FLASH below 61°C.

(7) INTERPRETATION

Liquid waste materials with a flash point less than 61°C are classified as hazardous wastes.

METHOD B. Viscous Samples or Samples Containing Solids

(2) EQUIPMENT

- 2.1 Pensky-Martens Closed Cup Flash Point Tester.
- 2.2 Thermometer with a readability of 0.5°C.
- 2.3 Barometer to read in mm Hg.
- 2.4 Natural gas supply.

(3) REAGENTS

- 3.1 1-Hexanol flash point 60°C

(4) PROCEDURE

- 4.1 Clean and dry the sample cup and all accessories before starting the test.
- 4.2 Fill the sample cup with the well homogenized sample to the level indicated on the inside of cup.
- 4.3 Close the cup with its lid, place the cup on the heating element and secure with the locking device.
- 4.4 Obtain barometric pressure.
- 4.5 Insert the thermometer into the sample.
- 4.6 Light the test flame and adjust it to 4 mm in diameter.
- 4.7 Turn the stirrer on at 90-120 rpm for viscous samples or to 250 ± 10 rpm for samples containing solids.
- 4.8 Adjust the heater control so that the temperature rises approximately 5°C per minute. Lower the heating rate to 1°C when the temperature reaches 55°C.

4.9 Depress the test flame over the surface of the sample within 0.5 second, leave lowered for 1 second and quickly raise the flame. Do not stir the sample when the test flame is lowered.

4.10 Perform the test at 30°C, 40°C, 50°C, 60°C or the respective corrected temperatures.

Note: *The following corrections must be made for pressure. For each 30 mm Hg interval below 760 mm Hg add 1°C to the flash point setting. For each 30 mm Hg interval above 760 mm Hg subtract 1°C from the flash point setting.*

4.11 Observe and record whether the flash occurs above or below 60°C.

Note: *The material is deemed to have flashed when a large blue flame appears and spreads over the surface of the sample. The last flame will extinguish with an audible popping sound.*

4.12 Allow the cup to cool and clean thoroughly.

(5) QUALITY CONTROL

Follow steps 3.1 to 3.12 using 1-hexanol (FP 60°C) as a test liquid.

(6) REPORTING

Report whether there was a FLASH / NO FLASH below 61°C.

(7) INTERPRETATION

Liquid waste materials with a flash point less than 61°C are classified as hazardous wastes.

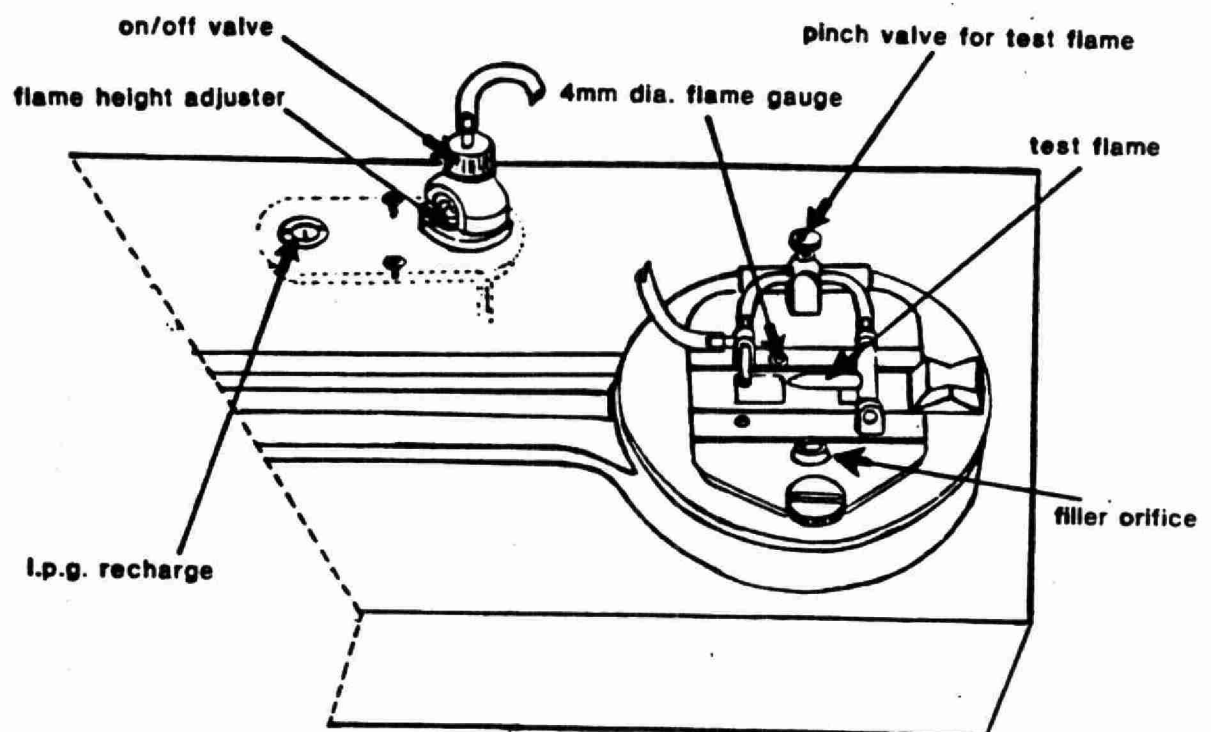


FIGURE 1
SETAFLASH FLASH POINT TESTER

THE DETERMINATION OF THE HEAT OF COMBUSTION OF A LIQUID INDUSTRIAL WASTE BY THE BOMB CALORIMETER

SCOPE

This method describes the procedures for the determination of the calorific value of a liquid industrial waste. A sample with an insufficient calorific value may not qualify as fuel that can be recycled.

THE DETERMINATION OF THE HEAT OF COMBUSTION OF LIQUID INDUSTRIAL WASTE BY THE BOMB CALORIMETER

(Isothermal Jacket Method)

(1) SAMPLING

Samples should be taken using techniques which ensure that the aliquot taken is representative of the waste to be tested.

(2) EQUIPMENT

- 2.1 Bomb Calorimeter, isothermal, consisting of thermal jacket, calorimeter bucket, oxygen bomb (Figure I).
- 2.2 Calorimetric thermometer; graduated from 19 - 35°C, in 0.02°C subdivisions, Readability 0.002°C with clip-on lens or preferably a recording calorimetric thermometer and a strip chart recorder.
- 2.3 Ignition Unit with firing wire
- 2.4 Pellet Press, with 1.27 cm dia. die, 1000 lbs pressure.

(3) REAGENTS

- 3.1 Alkali, Standard Solution (0.0725N): Dissolve 3.84 g of Na_2CO_3 in water and dilute to 1 L.
- 3.2 Benzoic Acid, Standard: Benzoic acid, (ACS grade), compressed into a pellet, with a weight not less than 0.9 g and not more than 1.1 g.
- 3.3 Methyl orange or Methyl red indicator solution.
- 3.4 Oxygen, commercial grade, free of hydrocarbons.
- 3.5 2, 2, 4 Trimethyl pentane.

(4) PROCEDURE

4.1 Determination of the energy equivalent of the calorimeter

- 4.1.1 Combust benzoic acid pellets at least six times over a period of not less than 3 days following steps 4.22 to 5.2.3.
- 4.1.2 Calculate the average energy equivalent of the calorimeter using the formula:

$$W = \frac{(H \times g) + e_1 + e_3}{t}$$

where

- W = energy equivalent of the calorimeter in calories per °C
H = heat of combustion of benzoic acid, 6318 calories/g
g = weight of benzoic acid pellet used
t = corrected temperature rise calculated as per step
e₁ = correction for heat of formation of nitric acid, in calories
e₃ = correction for heat of combustion of firing wire, in calories

4.2 Determination of heat of combustion

- 4.2.1 Weigh an aliquot of the sample (to the nearest 0.1 mg) into the sample cup so that the temperature rise produced is equal to that from 0.9 to 1.1 g of benzoic acid. If the value is not known, determine it by trial and error, starting with a very small aliquot of the sample.
- 4.2.2 Add 1.0 mL of water to the bomb from a pipet.
- 4.2.3 Place the sample cup in the bomb and connect the firing wire.
- 4.2.4 Charge the bomb with oxygen to 30 atmospheres gauge pressure at room temperature.

CAUTION: DO NOT OVERCHARGE THE BOMB AS IT MIGHT EXPLODE!

- 4.2.5 Adjust the calorimeter water temperature before weighing as follows:
Isothermal Jacket Method: 1.6 to 2.0°C below jacket temperature.
 - 4.2.6 Add 2000 g of water to the calorimeter jacket. The same amount of water must be used for all tests.
 - 4.2.7 Assemble the calorimeter in the jacket and start the stirrer and stir for 5 minutes.
 - 4.2.8 Record the calorimeter temperature at 1 minute intervals for 5 minutes.
 - 4.2.9 Fire the charge at the start of the sixth minute and record the time and the temperature t_a .
 - 4.2.10 Add to this temperature, 60% of the expected temperature rise.
- Note:** *The time at which 60% of the temperature is reached can be determined by recording temperatures at 45, 60, 75, 90, 105 seconds after firing and extrapolating.*
- 4.2.11 Record the temperature at 1 minute intervals on the minute until the difference between two consecutive readings has been constant for 5 minutes.
 - 4.2.12 Remove the bomb and carefully release the pressure over a period of time greater than 1 minute. Examine the contents of the bomb for evidence of incomplete combustion such as unburnt sample, soot. Repeat the test if combustion is incomplete.
 - 4.2.13 Transfer the contents of the bomb into a beaker and wash the bomb with a fine jet of water and collect the washings in the same beaker.
 - 4.2.14 Titrate the solution in the beaker with standard alkali using methyl orange or methyl red as an indicator.
 - 4.2.15 Determine the % sulphur in the bomb solution.

- 4.2.16 Remove and measure the length of the unburnt wire. Record the difference of wire consumed.

(5) CALCULATIONS

5.1 Calculate the temperature rise t as follows:

$$t = t_c - t_a - r_1(b - a) - r_2(c - b)$$

where

t = corrected temperature rise

t_c = temperature at time c, corrected for thermometer error

t_a = temperature at time a, corrected for thermometer error

r_1 = rate ($^{\circ}\text{C}/\text{min}$) at which temperature was rising during the 5 minute period before firing

b = time when temperature rise reaches 60% of total (to 0.1 min)

a = time of firing

r_2 = rate ($^{\circ}\text{C}/\text{min}$) at which temperature was rising during the 5 minute period after time c. If the temperature is falling r_2 is negative and $r_2(c - b)$ is positive.

c = time at the beginning of the period in which the rate of temperature change with time has become constant, after combustion.

5.2 Calculate the thermochemical corrections as follows:

5.2.1 e_1 = correction for heat of formation of nitric acid in calories
= mL standard alkali used in the titration

5.2.2 e_2 = correction for heat of formation of sulphuric acid in calories
= $14 \times \%S \times \text{wt of sample}$

5.2.3 e_3 = correction for heat of combustion of firing wire in calories
= $2.7 \times \text{cm iron wire consumed}$
or = $2.3 \times \text{cm Chromel C wire consumed.}$

5.3 Calculate the gross heat of combustion

$$H_g = \frac{tW - e_1 - e_2 - e_3}{g}$$

where

H_g = gross heat of combustion in calories/gram

t = correct temperature rise

W = energy equivalent of the calorimeter in calories /°C

e_1, e_2, e_3 are corrections in 5.2.1, 5.2.2, 5.2.3.

g = sample weight in grams

(6) QUALITY CONTROL

Use 2, 2, 4 trimethyl pentane to determine whether the results agree with certified values.

(7) INTERPRETATION

Liquids with insufficient calorific values may not be suitable as recyclable fuels.

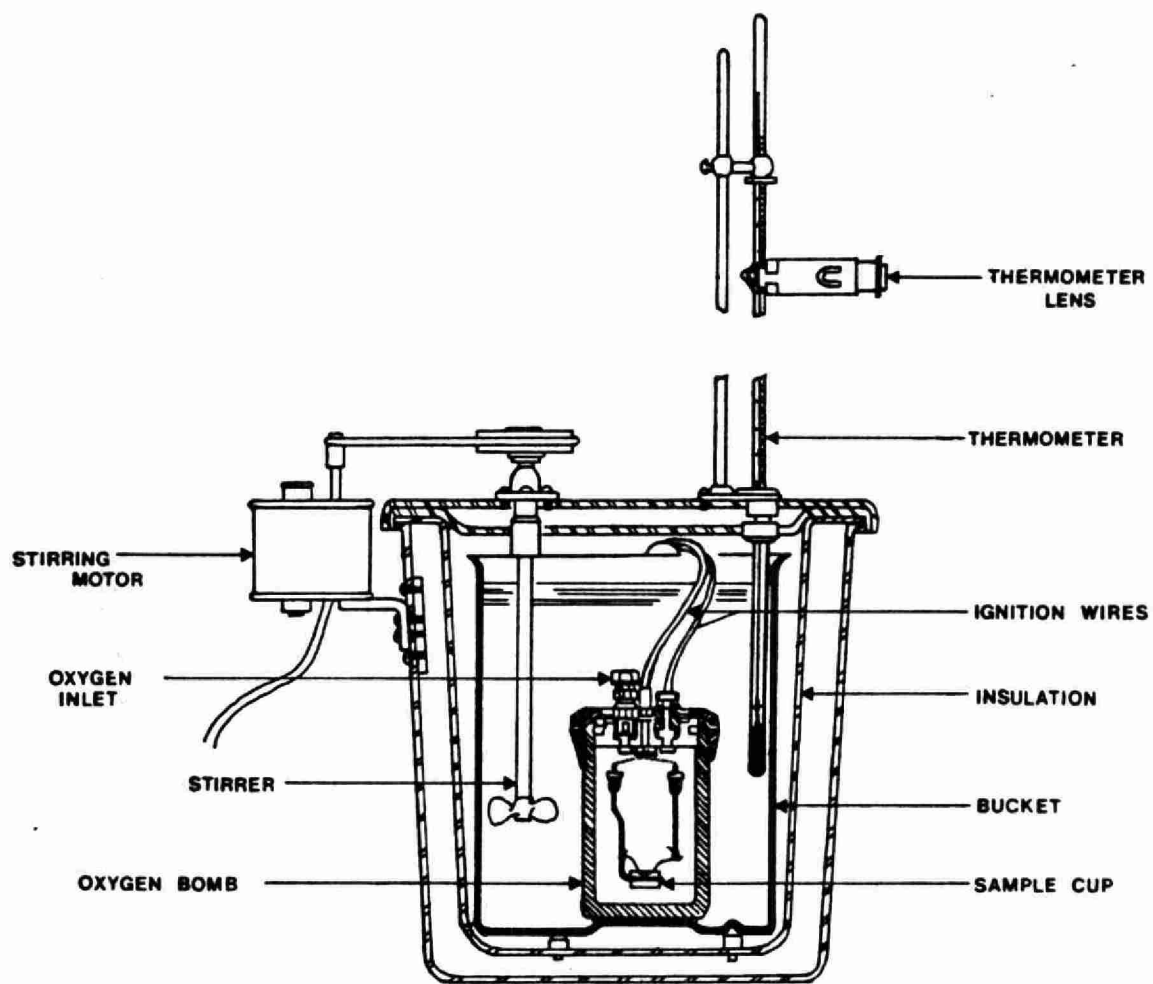


FIGURE 1

ISOTHERMAL JACKET OXYGEN BOMB CALORIMETER

**THE DETERMINATION OF WATER AND SLUDGE MATERIAL
IN LIQUID INDUSTRIAL WASTE**

SCOPE:

The method determines the amount of water and sludge material in a sample. It may be used to define which fuels can be recycled.

THE DETERMINATION OF WATER AND SLUDGE MATERIAL IN LIQUID INDUSTRIAL WASTE

METHOD A. Centrifuge

(1) SAMPLING

Samples should be collected using techniques which ensure that the sample taken is representative of the waste material to be tested.

(2) EQUIPMENT

- 2.1 Centrifuge, capable of whirling two or more specified centrifuge tubes in a horizontal plane, at a speed which can be controlled to produce a relative centrifugal force of 500 - 800 at the tip of the centrifuge tube. The speed of rotation is calculated as follows:

$$\text{rpm} = 1335 \frac{\text{rcf}}{d}$$

where rcf = relative centrifugal force

d = diameter of the swing in millimetres, measured between the tips of two opposite tubes in a horizontal position

The rpm to be used may also be obtained from Table I.

- 2.2 Centrifuge tube, cone shaped with dimensions shown in Figure 1. Calibration tolerances should meet specifications in Table II.
- 2.3 Water bath with a temperature control accuracy of $\pm 1^{\circ}\text{C}$.

(3) REAGENTS

- 3.1 Demulsifier, Tretolite F 46 or C 10.

- 3.2 Toluene, ACS grade. Add 25 mL of demulsifier and 3 mL of distilled water per 4000 mL of toluene. Shake to aid saturation and allow suspended water to settle, before using the toluene.

(4) PROCEDURE

- 4.1 Fill the centrifuge tube exactly to the 50 mL mark with toluene.
- 4.2 Pour the well homogenized sample into the centrifuge tube to exactly the 100 mL mark.
- 4.3 Stopper the tube and mix the sample thoroughly by vigorous shaking.
- 4.4 Immerse the tube into the heated water bath for 10 minutes at a water temperature of $49 \pm 1^{\circ}\text{C}$.
- 4.5 Shake the tube vigorously again and place in the centrifuge holder, with an equivalent tube on the opposite side to maintain a balanced condition. Centrifuge for 10 minutes using a speed calculated in Step 2.1 or determined from Table 2.

Note: *If the sample is viscous and does not mix well, heat the tube contents for 10 minutes at $60 \pm 1^{\circ}\text{C}$. The final temperature should not fall below 46°C between whirlings.*

- 4.6 Read and record the amount of water and sediment at the bottom of the tube with the following accuracy:
0.05 mL for 0.1 to 1 mL graduation
0.1 mL for above 1 mL graduation
- 4.7 Return the tube, without agitation, to the centrifuge and whirl for an additional ten minutes.
- 4.8 Repeat Step 4.7 until two consequent readings are the same.

(5) CALCULATIONS

Multiply the reading obtained in Step 4.8 by two to obtain the percentage water and sediment.

(6) REPORTING

Report results as percent water and sediment.

(7) INTERPRETATION

This test may be used to judge which wastes may be recycled.

Table II

Centrifuge Tube Calibration Tolerances

Range mL	Sub division mL	Volume Tolerance \pm mL
0 - 0.1	0.05	0.02
0.1 - 0.3	0.05	0.03
0.3 - 0.5	0.05	0.05
0.5 - 1.0	0.10	0.05
1.0 - 2.0	0.10	0.10
2.0 - 3.0	0.20	0.10
3.0 - 5.0	0.5	0.20
5.0 - 10	1.0	0.50
10. - 25	5.0	1.00
25. - 100	25	1.00

Table I

Rotation Speed for various diameters of swing
of the centrifuge arms

Diameter of swing mm	Rpm at 500 rcf	Rpm at 800 rcf
2500	597	755
3000	545	689
3500	504	638
4000	471	597
4500	445	562
5000	422	534
5500	402	509
6000	385	487
6500	370	468
7000	356	457
7500	344	436
8000	333	422
8500	323	409
9000	314	398
9500	306	387
10,000	298	377

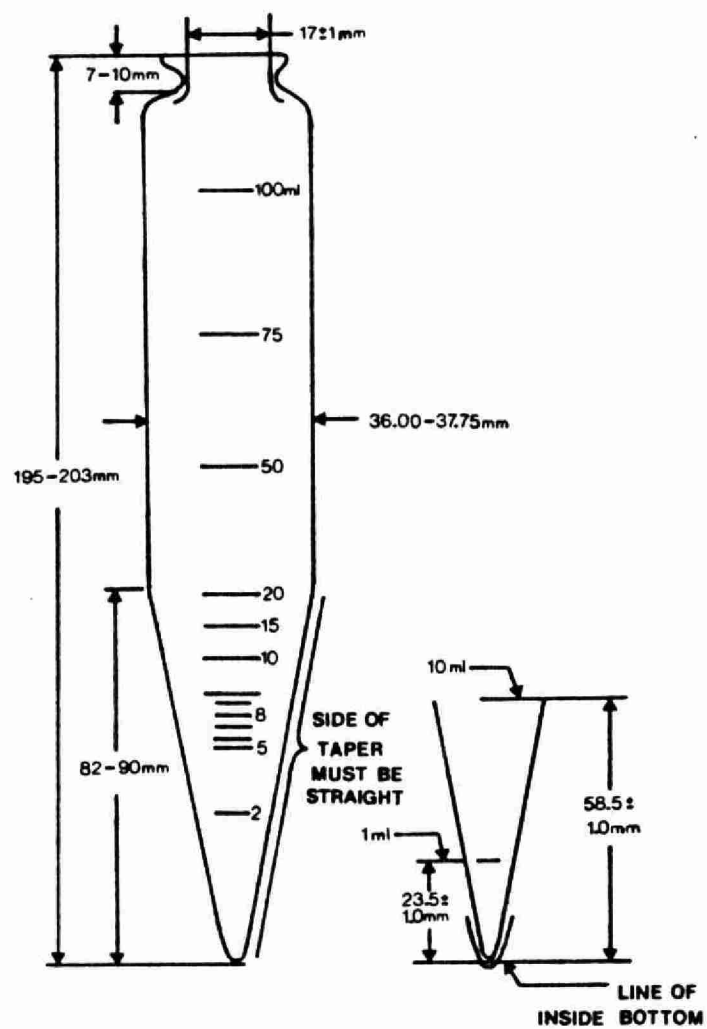


FIGURE 1

CENTRIFUGE TUBE FOR WATER AND SEDIMENT

THE DETERMINATION OF OIL AND GREASE

SCOPE

This method is used to determine whether a waste sample is an oily waste. If the amount of oil and grease is greater than 1%, a special leachate extraction procedure must be used.

THE DETERMINATION OF OIL AND GREASE (Freon Extraction Method)

(1) SAMPLING

Samples should be collected using techniques that ensure the aliquot taken is representative of the waste material to be tested.

(2) EQUIPMENT

- 2.1 Extraction Apparatus, Soxhlet
- 2.2 Extraction thimble, paper
- 2.3 Source of vacuum
- 2.4 Mortar, and pestle porcelain
- 2.5 Filter paper, analytical grade
- 2.6 Spatula

(3) REAGENTS

- 3.1 Hydrochloric acid concentrated
- 3.2 Magnesium sulphate monohydrate $\text{MgSO}_4 \cdot 2\text{H}_2\text{O}$. Prepare it by drying $\text{MgSO}_4 \cdot \text{H}_2\text{O}$ in an oven at 105°C for 24 hrs.
- 3.3 Freon (1,1,2- trichloro - 1,1,2- trifluoro-ethane), B.P. 47°C .
The solvent should leave no residue on evaporation
- 3.4 Cotton: degrease by washing with freon.

(4) PROCEDURE

- 4.1 Determine the solids content of the sample by drying it at 60°C to constant weight
- 4.2 Weigh out 50 ± 0.5 g of the dried sample into a dry 150 ml beaker.
- 4.3 Acidify the sample to pH 2.0 with concentrated HCl.
- 4.4 Add 25 g of $\text{Mg SO}_4 \cdot \text{H}_2\text{O}$, stir the sample well and spread it on the inside wall of the beaker.

- 4.5 Allow the sample to dry, approximately 30 min.
- 4.6 Transfer the dry solids using a spatula to a mortar and comminute the sample.
- 4.7 Transfer the material to the paper Soxhlet thimble.
- 4.8 Wipe the beaker and the mortar with pieces of filter paper until clean and add the paper to the thimble.
- 4.9 Add freon to the extraction flask and extract the sample at a rate of 20 cycles/hr. for 4 hrs.
- 4.10 Filter the sample through cotton into a tared (± 1 mg) flask.
- 4.11 Evaporate the freon by heating in a water bath at 70°C.
- 4.12 Remove the last traces of freon by heating on a steam bath for 15 min., using vacuum for the final 1 minute.
- 4.13 Cool the flask in a desiccator for 30 minutes and determine its weight.

(5) CALCULATIONS

$$\% \text{ Oil and Grease} = \frac{\text{gain in wt. of flask (g)} \times 100}{\text{wet of wet solids (g)} \times \% \text{ dry weight}}$$

(6) INTERPRETATION

If the % oil and grease is greater than 1% of the dry weight, a special leachate extraction procedure (for oily wastes) must be used.

THE DETERMINATION OF REACTIVE CYANIDE AND SULPHIDES IN INDUSTRIAL WASTES

SCOPE

This method is a rapid and simple procedure to determine whether a waste material is reactive because it releases hydrogen cyanide or hydrogen sulphide under acidic conditions.

THE DETERMINATION OF REACTIVE CYANIDE AND SULPHIDE IN INDUSTRIAL WASTE MATERIALS

(1) SAMPLING

Collect samples with a minimum of aeration in opaque sample bottle. Store samples in a cold dark place. Preserve samples by adjusting the pH to 12 using a sodium hydroxide solution. Analysis should be performed as soon as possible after sample collection.

(2) EQUIPMENT

- 2.1 Round bottom flask, 250 mL neck, with 24/40 joints.
- 2.2 Stirrer magnetic with stirrer bar.
- 2.3 Funnel, separating 125 mL with pressure equalizing arm, 24/40 joint.
- 2.4 Adapter tubes, straight glass, 24/40 joint, 2 each.
- 2.5 Tubing flexible, to connect detector tube to joint.
- 2.6 Detector tube for cyanide, 10-120 uL
(Draeger 67-28441 or equivalent)
- 2.7 Detector tube, hydrogen sulphide, 5-60 uL
(Draeger 67-28141 or equivalent)
- 2.8 pH meter
- 2.9 pH electrode, combination 18 cm long
- 2.10 Pump capable of drawing 60 mL \pm 5 mL per minute
- 2.11 Bubble meter
- 2.12 Stopwatch

(3) REAGENTS

- 3.1 Sulphuric acid, ACS grade 0.1 N
- 3.2 Cyanide reference solution: dissolve 2.5 g KOH and 2.51 g KCN in 1L of distilled water. Approximate concentration is 1 mg/mL. Store in refrigerator.

- 3.3 Sulphide reference solution: dissolve 0.80 g of $\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$ crystals, which have been prewashed in distilled water, in 100 mL of 0.1N NaOH. Standardize iodometrically as described in "Standard Methods for Chemical Analysis of Water and Wastewater" APHA, AMWA, WPCF, 15th Edition 1980, Method 427D.

(4) PROCEDURE

SAFETY PRECAUTIONS: ALL OPERATIONS MUST BE CONDUCTED IN A WELL VENTILATED FUME HOOD, WITH NORMAL SAFETY MEASURES.

- 4.1 Place 10 g or 10 mL of the sample in a beaker. Add approximately 80 mL of water and a sufficient amount of 0.1N H_2SO_4 to reduce the pH to 2. Note the volume of H_2SO_4 required.
- 4.2 Place 10 g or 10 mL of the sample in the reaction flask. Add a sufficient amount of water so that the total volume including the volume of the acid will be approximately 100 mL. Do not add acid at this stage.
- 4.3 Assemble the apparatus shown in fig. 1, using either the cyanide or the sulphide detector tube.
- 4.4 Calibrate the pump to a flow rate of 60 ± 3 mL/min using the bubble flow meter.
- 4.5 Ensure that all connections are air tight.
- 4.6 Add the 0.1N H_2SO_4 slowly till pH 2 is reached.
- 4.7 Note the length of the stain every 5 minutes for a period of 30 minutes.
- 4.8 Monitor and adjust the pH to 2 pH units.
- 4.9 Measure the length of the stain after 30 minutes.

Note:

The amount of sample should be adjusted so that a mid-range reading is obtained. Repeat the test with a larger or smaller aliquot, if necessary.

4.10 Calculations

$$\frac{\text{ug/g or ug/mL}}{\text{(gas evolved)}} = \frac{\text{detector reading (uL)}}{\text{Volume of gas (V) X sample amount (gm or mL)}}$$

$$\text{volume of gas (V)} = \frac{\text{flowrate mL/min X length of test minutes}}{1000}$$

(6) Quality Control

- 6.1 Test the efficacy of the entire system including the tubes using standard cyanide or sulphide solutions.

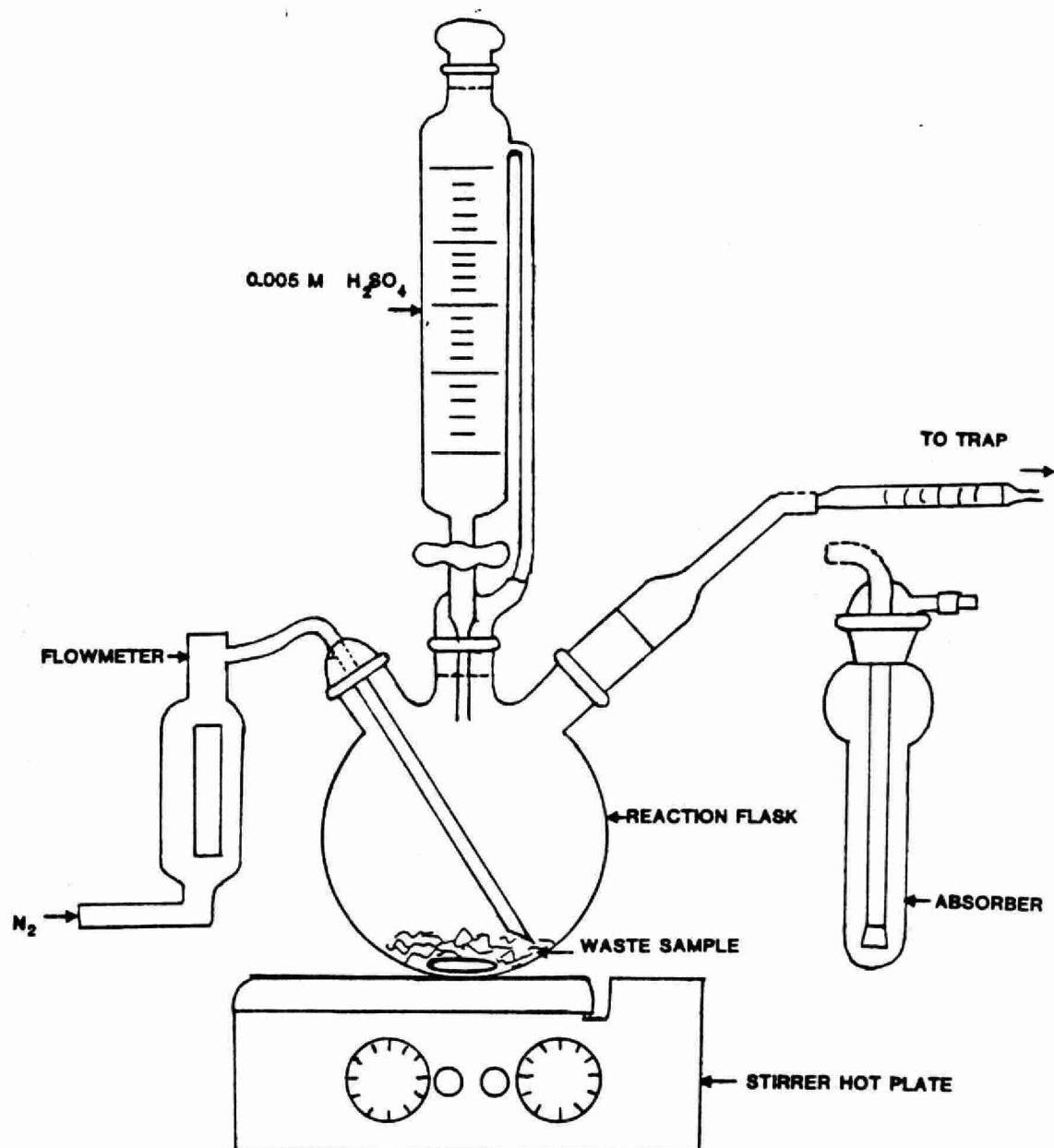


FIGURE 1

APPARATUS FOR REACTIVE CYANIDE OR SULPHIDE

**EQUIPMENT AND SUPPLIERS
FOR
BILL 309 AND ASSOCIATED TESTS**

The attached list contains diagrams and suppliers for Bill 309 and associated tests. Only equipment for Bill 309 tests should be considered at this time.

DISCLAIMER

THE MINISTRY OF THE ENVIRONMENT MAKES NO CLAIM THAT THIS LIST IS COMPLETE, NOR DOES IT ENDORSE OR RECOMMEND ANY SUPPLIER.

APPENDIX

List of Equipment and Suppliers

List of Suppliers

- (A) Alchem Inc.
118 Blair Road
Burlington, Ontario
L7M 1K9
(416) 827-7287
- (B) Aldert Chemicals Ltd.
648 Finch Avenue East
Willowdale, Ontario
M2K 2E6
(416) 223-0404
- (C) Canlab
80 Jutland Road
Toronto, Ontario
M8Z 2H4
(416) 252-5151
- (D) Consolidated Bottles Ltd.
77 Union Street
Toronto, Ontario
M6P 3J9
(416) 656-7777
- (E) Fisher Scientific
184 Rainside Road
Don Mills, Ontario
M3A 1A9
(416) 445-2121
- (F) Johns Scientific
175 Hanson Street
Toronto, Ontario
M4C 1A7
(416) 699-5555

- (G) LaSalle Glassblowing Ltd.
121 Malcolm Road
Guelph, Ontario
N1K 1A8
(519) 824-7301
- (H) Levitt Safety Ltd.
33 Laird Avenue
Toronto, Ontario
M4G 3S9
(416) 425-8700
- (I) Maynard Scientific
22 Lido Road
Weston, Ontario
M9M 1M6
(416) 745-9870
- (J) M & L Testing
580 Dundas Street West
Highway 5
Hamilton, Ontario
L9J 1B1
(416) 689-7327
- (K) Pall Canada Ltd.
240 Matheson Blvd. East
Mississauga, Ontario
L4Z 1X1
(416) 890-1013
- (L) Sargent Welch Scientific of Canada Ltd.
285 Garyray Drive
Toronto, Ontario
M9L 1P3
(416) 741-5210

(M) Spectrex Ltd.
5250 Ferrier Street,
Suite 508
Montreal, P.Q.
H4P 1L6
(514) 738-3377

Test Equipment and Suppliers

Leach Test

Supplier

- | | |
|------------------------------------|---|
| - Rotary Solid Waste Extractor | no Canadian supplier, must be constructed |
| - Pressure filtration apparatus | C,E,F,I, |
| - Vacuum filtration 90 mm diameter | H |
| - Filter media | C,E,F,H,I,K,L |
| - Bottles, 1250 mL | D |

Flash Point Testers

- | | |
|---------------------|---------|
| - Setaflash | C,E,F,I |
| - Closed cup tester | C,E,F,I |

Corrosivity

- | | |
|-------------------|-------------|
| - pH meter | C,E,F,I |
| - pH paper M & N | B |
| - NACE glass ware | C,E,F,G,I,L |
| - Electrodes | M |
| - SAE 1020 steel | A |

Slump Test

- | | |
|-----------------------|-----|
| - Slump cone and base | C,J |
|-----------------------|-----|

Water and Sediment

- | | |
|--------------------------------|-----------|
| - Centrifuge | C,E,F,I,L |
| - Centrifuge tube, Kimax 45244 | C,E,F,I,L |
| Kimax 45240 | C,E,F,I,L |

Calorific Value

- | | |
|---------------------------|-----------|
| - Parr Bomb or equivalent | C,E,F,I,L |
|---------------------------|-----------|

TEST EQUIPMENT AND SUPPLIERS

Water and Sludge Material

Supplier

C,E,F,I,L

Oil and Grease

C,E,F,G,I,L

Reactive Cyanide and Sulphides

C,E,F,G,I,L



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MOE/TES/ALRC

MOE/TES/ALRC

1986

Pimenta, J.

Test methods for

waste Characterization alrc
and classification c.1 a aa